

researcher. To do so would be "most misleading" if I had been dealing with spiritualism, but I was not. The title of my essay was "Science and Psychical Research," not "Science and Spiritualism." My plea to men of science is for a more scientific attitude of mind *towards psychical research*, not towards spiritualism.

Sir Bryan Donkin has gratuitously given his own interpretation to the words "supernormal phenomena," thereby ruling out all those manifestations which I consider to be the key to the whole situation. I have more than once stated that I do not know the difference between trance and sleep. If Sir Bryan does, will he please tell us? If he does not, why does he take up an attitude which will forever prevent the problem being solved? If some of our leading medical men would spare a little time, even though they be, as I am, hard-worked to the very limit, we should soon know something about this mediumistic state. But I have seen excellent supernormal phenomena produced with the medium wide awake and absolutely controlled and immobilised in good light; so the question as to what trance may or may not be does not touch the essentials of my argument. Sir Bryan cannot have it both ways. If he is opposed to the scientific examination of the trance state, then he takes an unscientific attitude towards this phenomenon and is another of those to whom my article was addressed. But if he thinks it ought to be studied, then he should range himself on my side in this discussion.

Mr. Dingwall, I can surely claim, agrees with me, for he uses my very words in his last paragraph. He says, "There is a good case for the scientific study of what are called supernormal phenomena." That is exactly what I said too! But the rest of his letter shows clearly what he wanted to imply, namely, that Dr. Tillyard had not seen enough supernormal phenomena to enable him to judge rightly. I concede readily that I have not seen anything like so much as Mr. Dingwall; if he were logical, he would *a fortiori* exclude Mr. Swinton and most other men of science from this discussion, as they have not even seen as much as I have seen. Why pick me out and leave them in?

Mr. Dingwall asks, very pertinently, "Can Dr. Tillyard tell us of any single medium who can produce some simple raps, under conditions which render their normal reproduction impossible?" Yes, I can. Stella C. has repeatedly, both in my presence and in that of many others, produced such raps inside a close Pugh Table at a distance from herself. Mr. Dingwall will doubtless criticise this experiment, as he has done to me personally, on the ground that, as the box is closed, nobody could really see what was going on inside it. Yet, in his report on the Margery mediumship he says that he particularly requested that the phenomena should be done inside a closed box, and, when this request was refused, he regarded it as highly suspicious. In other words, Mr. Dingwall is always ready with an argument *against* any particular experiment, even though his objections mutually destroy one another.

I would like to assure Mr. Dingwall that it is not the number of sésances that a man attends, but his capacity to draw definite conclusions, which really matters. Mr. Dingwall has attended hundreds, but he is still in a mental fog, just like the schoolboy whom we all know, who may be given an experiment to do many times over, but can never make a clear deduction from it. I am quite content with the eight sésances which I have attended. In two of them, undoubted evidence of fraud was easily discoverable. In one other there was no analysable result. In the other five, with three different mediums, definite supernormal results

followed under strict test conditions. In other words, I have obtained, *five times over*, a definite proof that supernormal phenomena do undoubtedly occur, and so I join the ranks of those who, like Lodge and Richet, are convinced of this fact. No amount of negative evidence can outweigh these positive results. Let me also assure Mr. Dingwall that I am not very likely to add largely to my psychic experiences, not being a hunter after sensations. I have seen Sir Ernest Rutherford's experiment on the bombardment of the atom demonstrated twice. It is enough. I accept the fact that the atom can be broken up, and no longer desire to go on attending lectures which keep on proving the same thing. I have seen supernormal phenomena in abundance produced at five controlled sésances. It is also enough to convince me that they occur. What is the true explanation of them remains still to me at least a partial mystery; according as the evidence may unfold itself in the future, I may yet find myself with either Sir Oliver Lodge or Prof. Richet.

Finally, let me again plead for a more scientific attitude of mind on the part of men of science towards psychical research. Perhaps I may live to see it, if I succeed in attaining the allotted span.

R. J. TILLYARD.

REFERRING to the discussion on this subject in previous issues of NATURE, might one ask: Is there not confusion regarding the aims of science and of psychical research, which at present are fundamentally dissimilar? We know that the object of experimental science, as distinct from philosophy and mathematics, is to obtain control over the energies of Nature by learning the laws inherent in matter; that science has never set a limit to the varieties of matter; that, consistent with its purpose, it accepts facts as it finds them; and that its function, *qua* science, has never been to prove *a priori* conceptions. Some of us forget, however, that the elementary conditions essential for the pursuit of its object are not compatible with the objects and conditions of psychical research. By way of contrast a simple statement of scientific requirements might be made as follows:

1. The first two indispensable and interdependent factors in any scientific problem are the trained research worker and *something to be examined*. The thing to be examined may not have been contacted by all the physical senses, as, for example, electricity; but it must have been experienced by means of one sense-faculty, at least, before it will come to the attention of human beings or within the range of scientific research. (Scientific instruments are merely the extension of our physical senses.) It was not necessary to prove the existence of electricity; the problem was first, how to induce, and second, how to control or direct it.

2. It is essential for real scientific research that the matter investigated be, to some extent at least, under the control of the investigator, and this is possible only through his knowledge of the laws which describe the action of energy under certain specified conditions.

3. Science has advanced each step in its progress on the knowledge of laws already ascertained. Much was known concerning the chemical elements and conductive materials before electro-chemical phenomena could be investigated. Every factor in an experiment cannot be new.

4. Science requires for each advance a working hypothesis or theory about what is next to be discovered. The theory may be proved wrong, but nothing at all can be attempted in fresh fields without

a tentative supposition, a temporary theory which suggests a particular line of investigation, or some reason for doing one thing rather than another.

Now, the phenomena described as 'psychic' cannot come within the purvey of science if we accept the conditions given above. Men of science cannot examine something non-existent to them, and of which, consequently, no data exist, for there is then no basis for a beginning. It is impossible to undertake to 'test' that about which we know absolutely nothing. Thus a Gilbertian situation arises when it is proposed to examine 'psychic phenomena' scientifically: (1) The matter to be tested has as yet no existence; therefore (2) we know no laws by which its action could be induced; (3) we have no theory regarding its nature, laws, or cause; (4) we cannot control its production; (5) we do not know the nature of the medium through which it is proposed to attempt to induce the phenomena; and (6) the investigator cannot control or direct the energies which supposedly must operate to produce results.

Before science can enter this field there would have to be (1) an acknowledgment, derived from experience, of the reality of psychic phenomena; (2) the formulation of a scientific theory or working hypothesis of the possible laws inherent in the matter of the phenomena; and (3) some means found by which the experimenter could control the operations of the experiment. One does not by this preclude the possibility of prediction by mathematical science of the existence of a kind of matter hitherto unknown, a hypothetical state of organic matter, acting under electro-magnetic laws, analogous to inorganic states of invisible electro-chemical matter. Such a prediction could arise only from a more exact knowledge of physiological and psychological activities; but the first step in a true scientific investigation of 'psychic phenomena' cannot be taken until some deduction or other is attempted. It is necessary, therefore, for serious investigators of this phenomena, who affirm its existence, to state a case, to enunciate a working hypothesis not contradictory of the fundamental principles of exact science. The collection of instances and theories thereon, or hit-and-miss experiments in the vague expectation that something will be discovered, have never, and could never, in themselves, evolve a science. Terms used should be defined in such a way as to conform to the 'uniformity of Nature,' which is the one great deductive theorem of science. We know, however, that, although man is included in Nature in the largest sense of that term, science has as yet gained control only of energies latent in the mineral forms of existence and of *states preceding mineral precipitation*. The energies of the forms that *succeed*, i.e. of plants, animals, and man, have not been made subject to exact science. We have no practical knowledge of the laws that originate organic forms and govern their growth. Further, no man of science can alter the temperament or constitution of a human being, nor can he *isolate sensations, emotions, or thoughts from exterior influence and regulate them according to prescribed formulæ*. Hence, scientific attempts to isolate a 'medium' are childish. Equally puerile are 'tests' by measuring instruments. The *vacuum tube* preceded the measurements of the phenomena of modern physics. What is to be the vacuum tube for psychical investigation?

W. W. L.

How can the methods of scientific research be applied to the subject of the spirit world, which is of such post-vital interest to us all? To do so under existing conditions is generally impossible and always

difficult. Faraday wrote to a friend: "I have been busy turning the tables on the table-turners." That statement was based on the results of definite experiments carried out under his own conditions.

In present circumstances, to follow Faraday's example and apply science to psychics is not easy. Would any manager of importance take his medium to the Royal Institution and submit without reserve to laboratory conditions?

Cannot the difficulty, if it does exist, be overcome by the use of scientifically trained mediums? Suppose, for example, prominent spiritists were engaged, in the first instance, to examine the staffs of colleges and scientific institutions throughout the country. It is probable that from such plentiful material a sufficient number of mediums of even moderate power could be obtained, when it is remembered that from one family alone a father, two daughters, and a son-in-law were all able to practise successfully as mediums. It would be desirable to exclude all who already have committed themselves intensely, those whose interest is mercenary, writers of imaginative articles for profit, those who seek prominence, and those imbued with the spirit of mischief.

Given the willing medium whose sole interest is science, and given suitable laboratory conditions, it should be possible to test the scientific basis of the claims of spiritists. It might even be possible to entice a ghost between crossed Nicols.

JAMES WEIR FRENCH.

Anniesland, Glasgow, W.2,
October 6.

Transmission of Stimuli in Plants.

THE transmission of stimulation past a discontinuity has been demonstrated in *Mimosa* by Prof. Ricca and confirmed by Mr. Snow and others. On the other hand, Sir J. C. Bose has stated (*NATURE*, vol. 115, Jan. 10 and March 28, 1925, and also *Proc. R. S.*, Series B, 98, p. 290) that he was unable to obtain this result.

I have for some time past been engaged in work on the transmission of stimulation in *Mimosa pudica*. Apart from my main line of work, and more as a matter of interest than from any doubt as to its validity, I have attempted to repeat this experiment. The method used was that described by Mr. Snow (*Proc. R. S.*, Series B, 96, p. 349) in which the two parts of the shoot are connected together by a piece of water-filled rubber tubing.

The directions given by Mr. Snow were followed carefully, but for a long time I was not successful in obtaining the transport of the stimulus past the cut, although the experiment was repeated on a number of different occasions. The cause of the failures was finally found to be due to minute bubbles of air which emerged from the pith as the tension in the water increased. These bubbles collected in the space between the cut surfaces and interrupted the continuity of the water separating the two portions of the shoot. In Mr. Snow's experiments this effect does not seem to have been encountered, but possibly Sir J. C. Bose's failures are to be attributed to this cause. It may be of interest to describe a method which I have found successful in avoiding this difficulty.

A shoot was cut into two halves under water and the portions placed in a beaker of water in such a way that the two freshly cut surfaces were completely submerged. The beaker was then put into a large empty desiccator from which the air was exhausted by means of a vacuum pump. In this way air was removed from the intercellular spaces of the pith of the cut internode and, when air was readmitted to the desiccator, these spaces became injected with